

Implementation Plan



Production Sector

Company Information

Partner Address Label Here

If the information provided above is incorrect,
please make corrections below.

Company Name:	Extraction Oil & Gas, Inc.
Gas Star Contact:	Kelly Kinsman
Position:	AQ Field Inspection/ Consultant
Address:	370 17th Street, Suite 5300
City, State, Zip Code:	Denver, CO, 80202
Telephone:	970-556-4712
Fax:	N/A
Email:	kkinsman@h2eincorporated.com

Implementation Plan Elements

ELEMENT 1 Best Management Practices (BMPs)

The following BMPs have been identified as significant opportunities to cost effectively reduce methane emissions from the production sector. They were selected based on their applicability to the industry, economic feasibility, and cost-effectiveness. There are two core BMPs for the production sector:

- | | |
|--------------|---|
| BMP 1 | Identify and replace high-bleed pneumatic devices |
| BMP 2 | Install flash tank separators on glycol dehydrators |

For detailed information on these BMPs, please refer to the *Lessons Learned* publications on the Natural Gas STAR website: epa.gov/gasstar/tools/recommended.html.

ELEMENT 2 Partner Reported Opportunities (PROs)

Current partners have reported many processes and technologies that are considered "other Best Management Practices" by the program. New partners are encouraged to evaluate and report current and new practices or technologies that cost effectively reduce methane emissions. PROs are made available to all partners, and can be viewed at: epa.gov/gasstar/tools/recommended.html.

ELEMENT 3 Inventory Past Reductions

Partners are encouraged to report past methane emission reductions back to 1990. Accounting for these historical reductions will create a permanent record of your company's methane emission reduction efforts. In addition, reviewing past activities will help guide companies' participation in Natural Gas STAR by creating a base of understanding of current activities to facilitate planning of future activities.

The Implementation Plan is designed to be a dynamic tool for Natural Gas STAR Partners to plan their program activities. As company priorities and plans shift over time, the Implementation Plan may be revised or updated by submitting a new form to the program.

ELEMENT 1
Best Management Practices

BMP 1
Identify and Replace High-Bleed Pneumatic Devices

Pneumatic devices used to control and monitor gas and liquid flows and levels in dehydrators and separators, temperature in dehydrator regenerators, and pressure in flash tanks emit large amounts of methane into the atmosphere. Replacing these with low- or no-bleed devices reduces or eliminates emissions and improves safety.

Estimated Reduction
Potential
124 Mcf/year/device

Will you be implementing this BMP? ☒ Yes ☐ No

If no, why?

☐ Not cost effective

☐ May consider at a later date

☐ Other _____

Please describe: _____

Already implemented as required by Colorado Reg. 7

If yes, at what scale will you be implementing this BMP?

☒ Company Wide

☐ Pilot Project

☐ Other

Please describe: _____

Activity Summary

Number of high-bleed pneumatic devices in system? 0

Number of high-bleed pneumatic devices to be replaced? NA

There are no high-bleed pneumatic devices in Extraction's system at this time. Therefore, there are none to replace.

Replacement Schedule

Number of high-bleed pneumatic devices to be replaced by the end of: N/A. Already been replaced.

Year 1: NA Year 2: NA Year 3: NA Year 4: NA

Additional Information on Anticipated Plans and Projects

If additional space is needed, please continue on the back.

Extraction Oil & Gas, Inc. was required to reduce and eliminate high bleed pneumatic devices as part of Colorado Reg. 7 requirements, beginning in 2014. Through 2015-2016 acquisitions, Extraction replaced high bleed pneumatic devices on newly acquired, legacy facilities. Currently, Extraction does not utilize high-bleed pneumatic devices. All previously existing high-bleed pneumatic devices have already been replaced with low-bleed or intermittent pneumatic devices.

BMP 2
Install Flash Tank Separators on Glycol Dehydrators

Installing a flash tank separator in a glycol dehydrator facilitates the removal of methane and natural gas liquids from the glycol stream. The recovered gas can be put back into the pipeline, used as a fuel on-site, or flared.

Estimated Reduction
Potential
170 scf/MMcf of throughput

Will you be implementing this BMP? ☐ Yes ☒ No

If no, why?

- ☐ Not cost effective
☐ May consider at a later date
☒ Other _____

Please describe: _____

Extraction does not operate, nor have plans for future operation of, glycol dehydrators at this time.

If yes, at what scale will you be implementing this BMP?

- ☐ Company Wide
☐ Pilot Project
☐ Other _____

Please describe: _____

Activity Summary

Number of glycol dehydrators currently equipped with flash tank separators _____

Number of glycol dehydrators suitable for flash tank installation? _____

Replacement Schedule

Number of flash tank separators to be installed by the end of:

Year 1: _____ Year 2: _____ Year 3: _____ Year 4: _____

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ELEMENT 2

Partner Reported Opportunities

PROs (Partner Reported Opportunities)

Your company may take advantage of additional technologies or practices to reduce methane emissions. These can be reported to Natural Gas STAR as PROs. Following is a list of some of the PROs that have been reported by other Natural Gas STAR partners, which may be applicable to your operations (for more information on these PROs, please view: epa.gov/gasstar/tools/recommended.html).

- | | |
|---|---|
| <ul style="list-style-type: none"> ☆ Install Vapor Recovery Units (VRUs) on storage tanks ☆ Artificial lift: Install plunger lifts in gas wells ☆ Reduce venting from unlit pilot: install electronic safety devices | <ul style="list-style-type: none"> ☆ Install instrument air systems ☆ Eliminate unnecessary equipment and/or systems ☆ Perform reduced emissions completions for hydraulically fractured natural gas wells |
|---|---|

PROs you will be implementing	Please describe
<p>PRO <u>Install Electric Compressors</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other <u>As feasible</u> </p>	<p>Extraction utilizes electric compressors to decrease methane emissions through reduction of natural gas service equipment associated with electric compressors. Eliminate methane emissions due to incomplete combustion. Electric compressors are installed and utilized as feasible according to availability of grid power, availability of electric motors, and economic feasibility.</p>
<p>PRO <u>Test/Repair PSVs</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input checked="" type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	<p>Methane emissions can occur due to pressure safety valve (PSV) leaking associated with wear, corrosion, or improper seating caused by debris. In order to prevent this from happening, Extraction performs annual inspections include cleaning, repairing, and replacing PSV valves as necessary. This inspection and repair activity is implemented company wide on an annual basis at minimum.</p>
<p>PRO _____</p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	
<p>PRO <u>Inspect Flowlines Annually</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input checked="" type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	<p>The inspection of flowlines reduces methane emissions by minimizing the potential for hydrocarbon leakage from flowlines. Every flowline company wide for Extraction is inspected on an annual basis at minimum. Flowlines in natural gas service are inspected at a higher frequency with the utilization of an IR camera. Flowlines in liquid service are inspected with a pressure test.</p>

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|---|---|

PROs you will be implementing	Please describe
<p>PRO <u>Utilize Electric Grid Power</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other <u>As feasible</u> </p>	<p>Extraction's utilization of electric grid power reduces methane emissions by eliminating the operation of natural gas driven power generators, and in some cases eliminating the operation of natural gas driven compressors. Implemented as available and economically feasible.</p>
<p>PRO <u>Install Flares</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other <u>As feasible</u> </p>	<p>In order to decrease methane emissions, Extraction installs enclosed combustion devices (flares or ECDs) as control devices on tanks as well as separators and other equipment. ECDs reduce hydrocarbon emissions by at least 98%. These are utilized at all large production facilities, and as feasible - depending on heat value and volume of gas at smaller production facilities in the fleet.</p>
<p>PRO <u>Install Electronic Flare Ignition Devices</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other <u>As feasible - All Flares</u> </p>	<p>Electronic flare ignition devices (auto-ignitors) decrease methane emissions by re-igniting the pilot on ECDs to keep it lit continually. Methane in the pilot gas is combusted and gas from various equipment that is sent to the ECD has no chance of being released instead of combusted. These auto-ignitors are utilized with every ECD in the Extraction fleet.</p>
<p>PRO <u>Utilize Instrument Air in Place of Gas Pneumatics</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input checked="" type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	<p>By utilizing instrument air or electrical actuated control devices in place of natural gas actuated pneumatics, methane emissions can be reduced by eliminating the potential for control devices to release natural gas while actuating. This is not economical, and has not yet been implemented by Extraction, however is planned to be implemented as a pilot project at a new facility in the near future.</p>

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|---|---|

PROs you will be implementing	Please describe
<p>PRO <u>Utilize LACT Units</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other <u>All new production facilities</u> </p>	<p>Extraction's use of Lease Automated Custody Transfer (LACT) Units reduces methane emissions by pumping condensate out of the tank battery and measuring the BS&W, and liquid volume transferred through the truck load-out line during load-out operations. The site operator is able to avoid opening the thief hatch to gauge the tank, and leaving it open during the activity. This technology is employed at all newly constructed facilities in the fleet, greatly reducing associated methane emissions.</p>
<p>PRO _____</p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other _____ </p>	<p>The construction and utilization of crude/condensate pipelines creates fewer emissions sources associated with truck traffic, oil load out and also consolidates control of emissions. This also allows for the capture of flash emissions versus venting at the time of each loadout event. This practice is implemented as a BMP, where technically and economically feasible.</p>
<p>PRO <u>Recover Gas During Condensate Loading</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other _____ </p>	<p>To capture and eliminate methane that would otherwise be vented during condensate load-out, Extraction installs connections from the tank truck vent line to a dedicated ECD. Eliminate or greatly reduce (by at least 95%) methane emissions associated with truck load-out activities. Methane is combusted that would otherwise be vented or cause a high pressure on the tank battery system.</p>
<p>PRO <u>Install VRUs on Storage Tanks</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input checked="" type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	<p>Extraction has been reducing gas pressure in the storage tanks by installing VRU gas compression systems on the vapor space of the tanks. Prevent emissions from light hydrocarbon vapors from flashing, working, and standing activities. Gas is compressed into sales line or other closed loop location in the facility which otherwise would cause pressure on the tank battery. Implemented where feasible, currently assessing performance.</p>

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|---|---|

PROs you will be implementing	Please describe
<p>PRO <u>Install Artificial Lift on Wells</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other _____ </p>	<p>Installing artificial lift, such as plunger lift, gas lift or other, to reduce methane emissions associated with well blow-down activities. Aging wells, without artificial lift, eventually require maintenance activities which cause methane emissions. Extraction implements artificial lift on many of its facilities in order to reduce instances of well maintenance and therefore reduce methane emissions. Gas is used for production and sales that would otherwise be vented.</p>
<p>PRO <u>Utilize Designated "Maintenance" Tanks</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other _____ </p>	<p>Maintenance tanks allow for the operator to perform well maintenance activities without opening the thief hatch of the tank battery to allow for blow-down or other activities. The use of maintenance tanks isolates the well and the tank used for maintenance, and therefore greatly reduced emissions associated with such activities. The use of this equipment is implemented at all new Extraction production facilities as a BMP.</p>
<p>PRO <u>Install Compressors to Capture Various Gas</u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input checked="" type="checkbox"/> Other _____ </p>	
<p>PRO <u> </u></p> <p>At what scale will you be implementing this PRO?</p> <p> <input checked="" type="checkbox"/> Company Wide <input type="checkbox"/> Pilot Project <input type="checkbox"/> Other _____ </p>	

ELEMENT 3

Inventory Past Reductions

An inventory of past reductions will help to create a permanent record of your past efforts.

As a first step, many new partners find it useful to inventory and document past methane emission reduction efforts. The inventory process helps companies quantify the success of their past activities and target future emission reduction efforts. Historical methane emission reductions identified as part of the inventory process can be reported to the Natural Gas STAR Program.

Will you inventory past activities to include in your annual report? ☒ Yes ☐ No

If yes, please describe your company's plans for reviewing past methane emission reduction activities.

Extraction plans to evaluate past methane emissions reduction activities by assembling an inventory of past activities on a source-related basis, and tracking the emissions reductions on an annual schedule. This will include quantifying past reductions related to emissions reductions efforts as a whole, and analyzing their holistic approach to methane reduction. Additionally, Extraction plans to evaluate those emissions reduction measures that were successful for implementation for future operations.

Some of the past emissions reduction activities include: Replacing pneumatic devices with low/no bleed, or more efficient alternatives; Installation of LACT units at specific facilities; green completions implemented for wells drilled prior to OOOOa requirements.

The Natural Gas STAR Program thanks you for your time.

Please send completed forms to:

Regular Mail

**The Natural Gas STAR Program
U.S. EPA (6207J)
1200 Pennsylvania Avenue, NW
Washington, DC 20460**

Express/Overnight Mail

**The Natural Gas STAR Program
U.S. EPA (6207J)
1310 L Street, NW
Washington, DC 20005**

Questions? Please call Jerome Blackman: (202) 343-9630 or Fax (202) 343-2202



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